

Association for Information Systems AIS Electronic Library (AISeL)

AMCIS 2007 Proceedings

Americas Conference on Information Systems
(AMCIS)

December 2007

Global Diffusion on the Internet: The Case of Uganda

Moses Niwe
Stockholm University

Victor Mbarika

Kibily Samake
Louisiana State University

Micheal Niyitegeka
Makerere University

Follow this and additional works at: <http://aisel.aisnet.org/amcis2007>

Recommended Citation

Niwe, Moses; Mbarika, Victor; Samake, Kibily; and Niyitegeka, Micheal, "Global Diffusion on the Internet: The Case of Uganda" (2007). *AMCIS 2007 Proceedings*. 503.
<http://aisel.aisnet.org/amcis2007/503>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2007 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

GLOBAL DIFFUSION OF THE INTERNET: THE CASE OF UGANDA

Moses Niwe, (niwe@dsv.su.se)

Department of Computer and Systems Sciences
Stockholm University and Royal Institute of Technology

Victor Mbarika, Ph. D. (victor@mbarika.com)

College of Business
Department of Management, Marketing, & E-Business
Southern University and A&M College

Kibily D Samake (ksamak1@lsu.edu)

E.J. Ourso College of Business
Department of Information Systems and Decision Sciences
Louisiana State University

Michael Niyitegeka, (mniyitegeka@cit.mak.ac.ug)

Computing & Information Technology
Makerere University

Abstract:

The Internet story in Uganda dates back to April 1993 with associations to a fidonet node at Makerere University, the largest institution of higher education of the country situated in the capitol city of Kampala. E-mail services in private companies became accessible in August 1994, making Uganda one of the first countries in sub-Saharan Africa to gain full Internet connection. In this paper, we intend to investigate the extent of Internet diffusion in Uganda. We will use the Global diffusion of the Internet (GDI) framework to assess Uganda Internet Readiness, Conclusive remarks are made, and suggestions that the government should implement the enacted policies to enhance the adoption and diffusion processes are recommended. The six GDI dimensions: Pervasiveness, Dispersion, Sectoral Absorption, Connectivity Infrastructure, Organizational Infrastructure, and Sophistication of Use will allow us to portray a clear picture of the Internet diffusion process while identifying the most significant barriers

Keywords: Global Internet Diffusion, Internet Readiness, Developing Countries, Sub-Saharan Africa, Information and Communications Technologies

GLOBAL DIFFUSION OF THE INTERNET: THE CASE OF UGANDA

1. INTRODUCTION

Internet diffusion as a source of strategic socio-economical development for the least developed countries (LDC) is not a new item on national and international agendas. By the end of the 1990s, international agencies were encouraging governments in developing countries to formulate Information and Communications Technology (ICT) strategies in which Internet-based businesses would have a central role. As the United Nations Conference on Trade and Development (UNCTAD) argued, *“enterprises in developing countries that are or plan to be involved in international trade need to start incorporating ICT and the Internet into their business models in order to stay competitive”* (UNCTAD, 2001).

The Government of the Republic of Uganda has recognized the importance of information and ICTs in its socio-economical development and has illustrated its commitment to ICT enhancement under the National plans for poverty reduction and sustainable development, Poverty Eradication Action Plan (PEAP), Plan for Modernization of Agriculture (PMA), Universal Primary Education (UPE), and Vision 2025 are various initiatives that strive to apply ICTs derived solutions to address some of the factors pertinent to socio-economical development. The Ugandan government established a fully fledged Ministry of ICT in 2006. If the national development programs of poverty eradication, decentralization of government service delivery, among others are to succeed, information ought to be available at all levels of the society, right from the national, districts, to sub-counties down. That is, open communication channels allow for information exchange in all directions as the information needs of various interest groups can be identified and fulfilled.

In this paper, we intend to assess the diffusion of the Internet in Uganda. Moreover, we will highlight the government's role, which has considerable impacts on the process. That's, policy makers have enacted many policies over the last few years. However, the application and enforcement of these policies has not follow up to expectations. In the next section, we will provide some background information on Uganda.

2. BACKGROUND

Uganda is a landlocked country located in East Africa, bordering the countries of Kenya, Tanzania, Zaire, Sudan, and Rwanda. Kampala, the capital, has a population of 1,208,544 inhabitants. Uganda is governed under the constitution as amended in 1995. The government is headed by a president, who is elected by a popular vote that serves a five-year term (CIA World Fact book, 2006). It covers an area of 236,000 square kilometers and has an estimated population of over 26 million people, of which 88% live in rural areas. Over the next five years, Uganda's population is projected to increase by more than 90%. This increase is likely to affect the proportion of the population living in rural areas, which is projected to decrease from the current 84% to 62%, and that in urban area -- projected to increase from the current 16% to 38% -- by the year 2009 (Uganda Bureau of Statistics, 2006).



Figure 1. Map of Uganda

Source: CIA World Factbook

Uganda's economy relies heavily on the performance of the agricultural sector, much like those of most African countries. Since the country's independence in 1962, agricultural exports make a heavy 44% to the Gross Domestic Product (GDP). With Coffee providing 50% of that and cotton 30%, tea 20% and tobacco, 20%. In addition to cultivation, 70% of the people's livelihood is from livestock, fishing and farming. Tourism and Ugandans in the diaspora bring in foreign exchange, which is proving to be a major income-earner for Uganda. Uganda's inflation lies between 5-7% with a fairly stable currency. The country's per capita income is US\$ 340.

3. GEOGRAPHY

The geography of a country plays an important role in the growth and expansion of the Internet. Most countries' geography constitutes major physical barriers to widespread Internet coverage due to a widely distributed population, rough terrain, a large landmass, or many islands. Uganda's geography indicates several obstacles to the diffusion of the Internet . (Minges et al., 2001) Although a landlocked country, Uganda has numerous water bodies like Lake Victoria, Albert, Kyoga and the source of the river Nile.. The terrain in Uganda consists of mostly plateaus with rim of mountains. With such geographical features and other determining factors, it will be difficult to expand the Internet throughout the country using the current access method of telephone lines.

4. UGANDA'S ICT INFRASTRUCTURE AND NETWORKS

Uganda has experienced a rapid growth in the telecommunications sector. The government has adopted policies to enhance the country ICT capacity through the liberalization of the sector. is the results of such initiative is responsible for most of the major developments. The government continues to exercise its role as a policy maker to create the environment needed for the developments. This has been done primarily through the establishment of government subsidies, to encourage companies like the South African based Mobile Telecom Network (MTN) that invest in ICTs infrastructures in the less profitable rural communities. The liberalization of the Telecom

Industry has led to exponential Internet growth. Both fixed line and mobile networks have experienced a 5-fold increase in the total number of users. Uganda's Internet market continues to grow in terms of both penetration and access. By December 1999, the number of Internet subscribers was 12,000. Presently, the number of Internet subscribers is 125,000. The first Internet supplier was the private company InfoMail (IMUL), which established a VSAT¹ based service via an InterSputnik satellite to the United States. Since then IMUL has combined with another Internet provider to establish Starcom, which is another segment of the U.S. based Starlight Communications. The new company is called InfoCom. Starcom is a Uganda licensed company sponsored by a multi-million dollar investment from Telenor (the Norwegian national telecom carrier), as well as by U.S. and Ugandan investors, including numerous mobile radio network, an international data network, and a pay phone system.

Uganda Communications Commission (UCC) is the government's regulator of the communications industry. UCC regulates and promotes development in the communications sector. The mission of the organization is to facilitate development of communication services that are universally accessible through effective regulation. The Uganda Communications Act of 1997 established the Uganda Communications Commission (UCC), which is a public sector organization. Its main objectives are to control and promote the growth of the communication sector in Uganda. UCC controls the Rural Communication Development Fund (RCDF), which is expected to obtain telecom operators to provide 2.5% of its growth revenues for rural communications. The UCC has been in existence for six years and is continuously expanding its operations. By April 2001, the Uganda Communications Commission had licensed over fifteen Internet Service Providers (ISPs). To date, we have over 25 ISPs although there are seventeen licensed ISPs, only eight are essential Internet providers. Presently, the leading ISPs are Infocom, BushNet, AfricaOnline, and one2net. UCC stopped issuing new International Data Gateway licenses in July 2000 at the start of the 5-year exclusivity period for the National Telecom Operators. However by then 8 providers had been licensed. The cost of VSAT terminals has dramatically dropped in recent years. Whereas such terminals used to cost several tens of thousands of US Dollars, a terminal can be purchased and installed for less than 4,000 US Dollars today, for small to medium Internet access needs. This technology is likely to play a crucial role in providing Internet access to rural Uganda.

Uganda has made significant decisions and acts in implementing ICT, but the most predominant technological growth has been evidenced by the mobile telephone. Other than radio technology, telephone access has infiltrated many rural communities much more than any other forms of ICT. Some factors include the relatively lower costs of purchase, installation and the skills required for use, specifically for mobile phone service. Fixed lines are costly to maintain, particularly in rainy seasons and poor terrain. Currently, Mobile Telephone Network (MTN) and Uganda Telecom Ltd (UTL) supply a wireless fixed phone service. In April 1998, Mobile Telephone Networks (MTN) Uganda was licensed by the government to become the second telecommunication network. Therefore MTN initiated its mobile services in October 1998 and fixed services in January 1999. This has led to increased telephone density in the country, and also the end of the domination enjoyed by the state-owned Uganda Posts and telecommunications Corporation.

Internet cafés or cybercafés are a crucial means for many to access the Internet in Uganda, especially in urban areas. According to the survey that was conducted by UCC in October 2005 in the capital Kampala and four other major towns (Jinja, Mbale, Lira and Mbarara), majority of Ugandans (80%) access the Internet via Internet Cafes (UCC; 2006). Cheaper Internet access has been a major reason of cybercafés growth and success as they attract a large number of Internet surfers. Cybercafés have graduated from emailing centers to hubs of e-commerce as increasing

¹ Very Small Aperture Terminal (VSAT)

numbers of people across the country book railway and airline tickets, shop for books and gifts, apart for looking for jobs and sending resumes. The result has been a meteoric growth in the number of Internet cybercafés, especially in Kampala, to address the increasing demand for Internet access. This has led to stiff competition among cybercafés evidenced by price-wars and intense advertising as the firms jostle for competitive advantage within this sector.

Table 1. Statistics of the ICT infrastructure in Uganda.

Service Providers	Number	Communication	Number
National Telephone Operators	2	Fixed Phone Lines	107,922
National Postal Operators	1	Pay Phone	10, 925
Mobile Telephone Operators	3	Mobile Cellular Subscribers	1,937,109
Internet Service Providers	17		
VSAT International Data Gateways	8		
Private FM Radio Stations	145		
Private Television Stations	34		
Courier Services	22		

Source: Uganda Communication Commission, 2006

5. ANALYTIC FRAMEWORK DIMENSIONS

5.1. GDI Framework of Internet Diffusion

We use the GDI framework to conduct our analysis of the extent of Internet diffusion in the country. The framework has six dimensions (Pervasiveness, Geographic Dispersion, Sectoral Absorption, Connectivity and Organizational Infrastructure, and Sophistication of Use). With each dimension, a score that ranges between 0 and 4 is given based on a group of fixed assessment criteria. (Wolcott et al., 2001).

The GDI Framework is distinctive in that it has two general emphases. Firstly, it looks at the absolute degree to which the Internet is being used (as measured in Connectivity and Organizational Infrastructure, and Sophistication of Use). Secondly, it has a strong diffusion focus, examining how widely the Internet is used geographically (Geographic Dispersion), among individuals (Pervasiveness) and organizations (Sectoral Absorption). Therefore, the framework offers a firm basis for the evaluation of Internet diffusion in a given country.

5.2. PERVASIVENESS

Pervasiveness is a measure based on users per capita and the degree to which non-technicians are using the Internet. Table 2 illustrates the numbers of Internet users in Uganda through the past years. The number of Internet users has grown tremendously with the latest statistics indicating that there were 500,000 users as per the month of September 2006 compared to 2000 when there were only 40,000 users, this is a remarkable 1,150% increase.

Table 2. Estimates of Numbers of Internet User

Date	USERS
late 1997	<8,000
late 1998	<12,000
late 1999	<25,000
late 2000	40, 000
late 2006	500, 000

Source: Internet world Stats; Uganda Communication Commission; (2006)

This chart (Table 2) portrays an exponential growth since the Internet was first introduced to the country. In late 1998, over 12,000 accounts were created. However, Uganda experienced significant growth in just a year with over 25,000 Internet accounts being created in late 1999. In late 1999, Uganda pervasiveness was rated at level 1, Embryonic. This component is described in Table 3. There are an estimated 500,000 users out of a population of nearly 27 million for an Internet user rate of 1.5%. Uganda's overall telephone density tripled between 1995 and 1999 rising from 0.21 telephone subscribers per 100 people to 0.67. The increase in Uganda's Internet users, since then, to over 125,000 and the subsequent population increase to over 26 million people, may have caused pervasiveness to increase to the next level (established).

Table 3. Pervasiveness of the Internet in Uganda

Level 0	Non-existent: The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however they obtain a connection via an international telephone call to a foreign ISP.
Level 1	Embryonic: The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	Established: The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	Common: The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	Pervasive: The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least one in ten (10% or greater).

5.3. GEOGRAPHIC DISPERSION

The geographic dispersion of the Internet can be estimated by examining how geographically dispersed the Internet is through the Points of Presence (POPs) located in a nation's first-tier political subdivisions, generally called regions in Uganda. All of the Internet Service Providers (ISPs) are located in Kampala however some have regional offices to serve the regional branches for the big Corporations. Digitalization of switches makes all calls in Uganda prefixed. The charges are normally per minute rates and in some cases there are options available to choose from. Uganda's geographic dispersion is rated at level 2, which is referred to as moderately disperse. Through the provision of subsidies RCDF has supported the establishment of Internet Points of Presence in 54 districts of Uganda (UCC; 2006).

Table 4. Geographic Dispersion of the Internet in Uganda

Level 0	Non-existent: The Internet does not exist in a viable form in this country. No computers with International IP connections are located within the country. A country may be using UUCP connections for e-mail and USENET.
Level 1	Single location: Internet points-of-presence are confined to one major population center.
Level 2	Moderately dispersed: Internet points-of-presence are located in multiple first-tier political subdivisions of the country.
Level 3	Highly Dispersed: Internet points-of-presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	Nationwide: Internet points-of-presence are located in essentially all first-tier political subdivisions of the country. Rural access is publicly and commonly available.

5.4. SECTORAL ABSORPTION

Sectoral absorption is a measure of the degree of utilization of the Internet in the education, commercial, health care, and public sectors. Uganda is rated at level 2, which means Moderate. The ranking is a function of the level of connectivity, server ownership in business, government, health care, and education, each of these are rated as rare themselves. In areas such as health and government, connectivity is moderate and limited to dial-up access. Several organizations operate their own servers. Tables 5 and 6 explain in more details the sectoral absorption as of 2003.

Table 5. Absorption of the Internet by Sectors of Uganda Economy

Sector	Minimal (1 point)	Medium (2 points)	Great Majority (3 points)
Academic (primary secondary and secondary schools, universities)	>0%-10% leased line Internet connectivity	10%-90% leased line Internet connectivity	90% leased line Internet connectivity
Commercial	>0%-10% Internet Servers	10%-90% Internet Servers	90% Internet Servers
Health (hospitals and clinics)	>0%-10% leased line Internet connectivity	10%-90% leased line Internet connectivity	90% leased line Internet connectivity
Public (top- and second-tier government entities)	>0%-10% Internet servers	10%-90% Internet servers	90% Internet servers

Table 6. Sectoral Absorption of the Internet in Uganda

Sectoral Point Total	Absorption Dimension Rating
0	Level 0: Non-existent
1-3	Level 1: Rare
4-6	Level 2: Moderate
7-9	Level 3: Common
10-12	Level 4: Widely Used

As in many developing countries, government resources for schools and teachers are inadequate and the low income of the majority of the population limits the feasibility of private financing for education. The educational system in Uganda is divided into three categories: primary, secondary, and tertiary institutions (post secondary). The majority of government funding for education is geared towards the primary level where there are around five million pupils and 85,000 teachers. There is no policy for computer exposure during early schooling; therefore, computer usage at the primary levels is minimal.

Computer education is now part of the traditional national program for secondary schools facilitated by the ministry of education. Computer based learning practices and online resources for secondary schools under the auspices of the School Net programme have been developed. In the new national policy there are plans for Internet connections and setting up ICT training centers at district levels. Under the UPE national programme all the 15,000 schools involved should get Internet connectivity.

Uganda has a number of universities, the largest is Makerere University situated in Kampala. Makerere University was instituted in 1922 and is the oldest in East Africa. Makerere has been involved with the Internet since its inception. One of the original references to the Internet in Uganda reveals the existence of a Fidonet (a network for exchanging e-mails) node at Makerere University as early as April 1993. Today, this university has about 1500 computers, with several connected to Local Area Networks. The private universities do attach a lot of emphasis on the role of ICTs in education and investing substantial amounts of money in such projects.

The Ministry of Health demonstrated a high level of understanding of the benefits of ICTs in the health delivery processes. One of the main goals of the Health Sector is generating awareness and sense of urgency for the need for computer literacy and use of ICT products. The Ministry of Health has about 200 computers of which 120 are installed at its head-quarters but most are used for administrative functions only. The greatest level of Internet and e-mail connectivity can be found at the Makerere University Medical School, where researchers, staff, and students have access to the World Wide Web. It is projected that each sub county headquarters and health center will have Internet connectivity within a radius of about 10 kilometers by 2010.

The Ministry of Finance Planning and Economic Development runs an integrated Enterprise Resource Planning (ERP) system for the government ministries. This financial system enabled the ministry to monitor and track expenditures in ministries and some local government agencies.

In Uganda, government ministries have been challenged to adopt Information Communication Technology (ICT) policies if they ought to achieve the millennium development goals. ICT is a stimulant in many development processes and could, if prioritized by individual government ministries, help to eradicate poverty, improve healthcare and promote education. Senior government officials have accredited the limited use of computers in countless ministries to two major factors; the lack of awareness of the use of computers as information and communication tools, and the high price of computers.

5.5. CONNECTIVITY INFRASTRUCTURE

Connectivity infrastructure is a measure based on international and intra-national backbone bandwidth, exchange points, and last-mile access methods. Table 7 specifies Uganda's connectivity infrastructure level (Expanded) as of February 2000.

Table 7. Organizational Infrastructure of the Internet in Uganda

Level	Domestic Backbone	Internet Connectivity	Internet Exchanges	Access Methods
0: Non-existent	None	None	None	None
1: Thin	<=2 Mbps	<=128 kbps	None	Modem
2: Expanded	>2Mbps- 200 Mbps	>128 Kbps- 45 Mpbs	1	Modem 64 Kbps leased lines

3: Broad	201 Mbps- 100 Gbps	46 Mbps- 10 Gbps	More than 1; Bilateral or Open	Modem 64 Kbps leased lines
4: Extensive	>100 Gbps	>10 Gbps	Many; both Bilateral and Open	<90% modem 64 Kbps leased lines

5.5.1. Internet Connectivity

Uganda was one of the first countries in East Africa to attain a complete Internet connection. The first supplier of Internet services was InfoMail by establishing a VSAT-based service via MSN in the USA. The second ISP in the country was STARCOM, a Uganda licensed company sponsored by a multi-million dollar investment from Telenor (the Norwegian national telecom carrier), as well as by US and Ugandan investors. InfoMail and STARCOM later merged and formed a new ISP called Infocom. Infocom is now considered one of the three major Internet Service Providers along with MTN and UTL. The ISP business rose to a Level 1.5, between Thin and Expanded for International connectivity, via a variety of VSAT and satellite links. Even the bandwidth increased to a 384 Kbps.

The Internet cafés have increased to at least one in each district with majority in major towns and cities like Kampala, Entebbe, Jinja. Communication by e-mail has increased as well, mainly through projects funded by the Uganda Communication Commission Rural Communications Development Fund (RCDF). In the last seven years Uganda's connectivity was at 0.26 percent, but this has since grown to 15,000 of both fixed and mobile services at 25 percent increase.

With the deployment of latest technologies like Wi-Fi and Wimax the service providers are making it possible to access the Internet more easily. WiMax is able to carry more than 70Mbit/s connection over 50km making it ideal for the deployment of broadband in areas where no infrastructure currently exists. These technologies allow for scalability and are currently being tested by the business sector. Infocom and Bushnet are two of the service providers that are championing the use of these technologies (Figure 2).

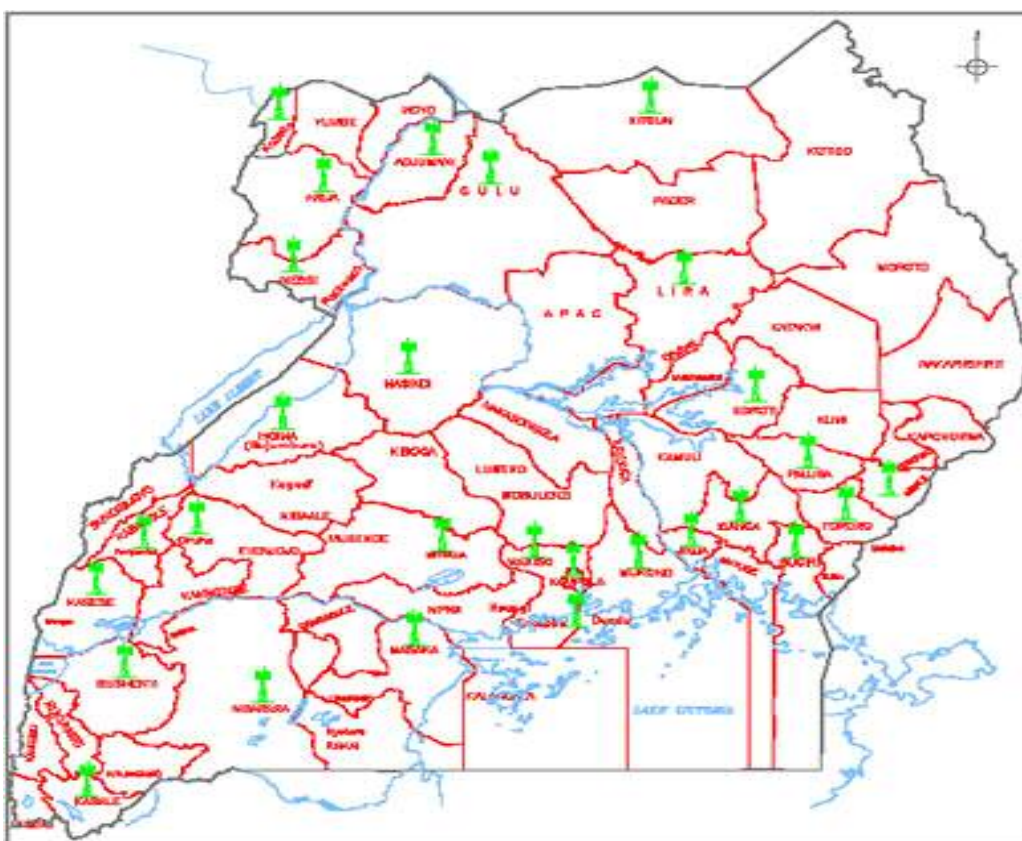


Figure 2. Bushnet Coverage

5.5.2. Domestic Backbone

In Uganda, there is a microwave national backbone for the telephone network, which could be adapted for use of the Internet. In addition to two mobile operators, they are also building microwave networks. The majority of the backbone network is supplied by microwave links. International connectivity is offered primarily by a satellite earth station at Mpoma, near Kampala. A majority of Uganda's Internet passage is routed outside the country. (Minges et al., 2001) Bandwidth controls the amount of data that can be passed along a communications channel in a given period of time. A higher bandwidth means a lot of data can be transferred within a short period of time. (Muhwezi-Bonge, 2006) The construction of the national fiber optical cable backbone is in its implementation stage. Currently the fiber optical cable runs from Busia to Mbarara. MTN and UTL both have fiber optical cables rings in Kampala. The national service providers have a range of products with varying bandwidth e.g. UTL has the following products with corresponding bandwidth;

ADSL	256kbps – 6Mbps
HDSL	Fixed rate of 2Mbps
ISDN	64Kbps – 128Kbps

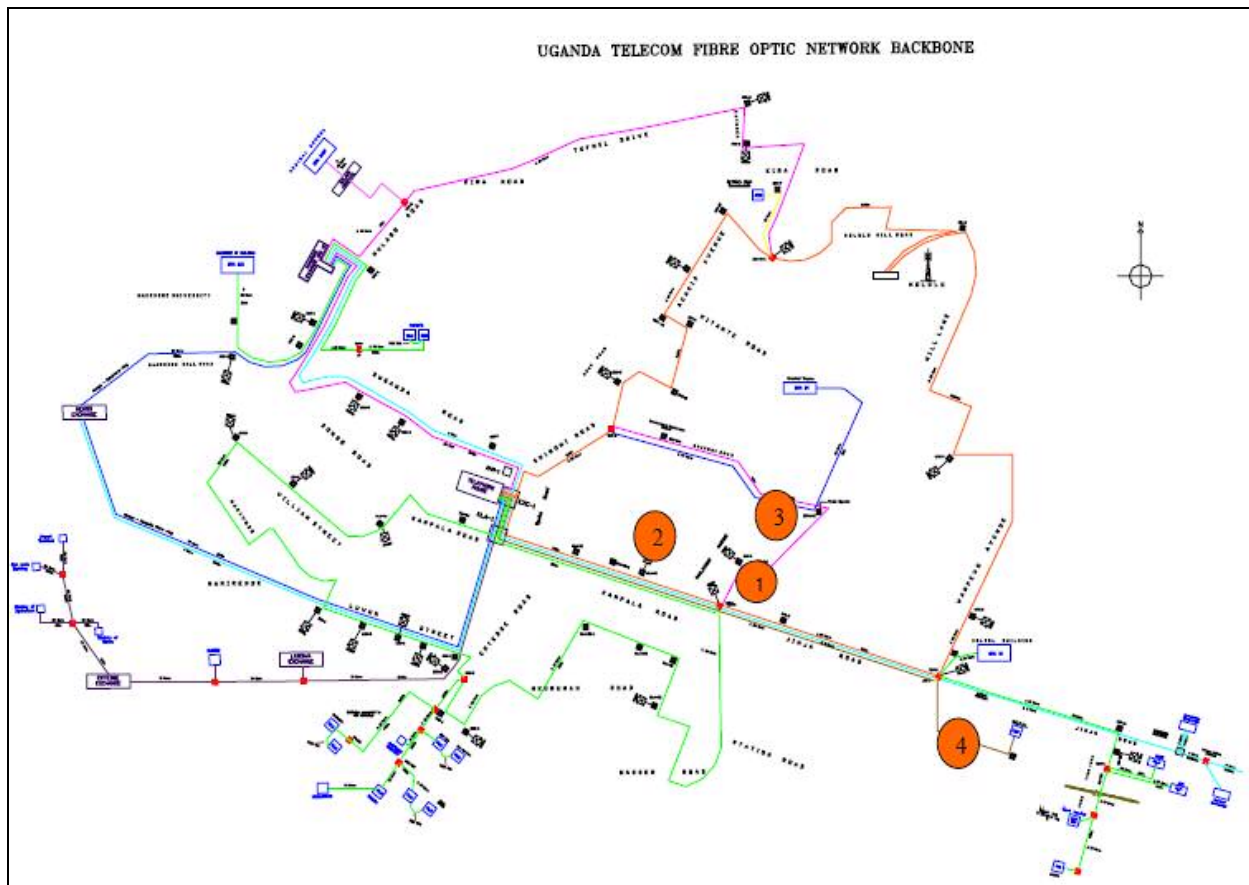


Figure 3. Fibre Optic Network

5.5.3. Internet Exchanges

An Internet exchange point (IX or IXP) is a tangible infrastructure that enables various Internet Service Providers (ISPs) to exchange Internet passage between their networks by means of joint peering agreements, which allow passages to be exchanged without expense. The principal use of an IXP is to enable networks to interconnect directly, via the exchange, rather than through other networks. Without having a domestic Internet exchange, passage from one ISP to another within the same country must initially travel outside the country to a global connection point (Wolcott et al., 2001). Ugandan IXP is at an exclusive phase of development. Technical operations are currently under construction and the Uganda Communications Commission, which has already granted Ugandan IXP a license, has shown committed support for this endeavor. Without question, domestic Internet exchanges will reduce cost and increase speed of global Internet connectivity to Uganda (McLaughlin, 2004). Worth noting is that, there is an initiative by stakeholders of Uganda's local Internet community for a robust, fast, and stable local Internet backbone (UiXP; 2006)

5.5.4. Access Methods

There are two different forms of access methods in Uganda. One of the access methods is "last mile" connections, which flows mainly into homes that normally uses modems, but may now be converting to cable, DSL, or even other forms of access. The second form of access is via leased line. Most Internet access that takes place in Uganda is via dial-up; however, demand for leased-

lines is growing rapidly from frequent users eager to avoid telephone usage charges (Wolcott et al., 2001).

Very few Ugandan citizens can afford the ICT equipment and related service cost. Therefore the majority of the citizens rely on community Internet access points. With the establishment of the 54 PoP in the 54 districts and the yet 22 PoPs to be established under the RCDF, access is going to greatly improve. “Under the same project 54 ICT training centers and 50 Internet cafes have been set up countrywide through competitive bidding process for government subsidies of private sector firms ” (UCC; 2006). Uganda’s focus must be placed on creating more POPs, such as telecentres and cybercafés to increase Internet accessibility to Uganda citizens (Minges et al., 2001).

A study conducted by UCC in October 2005, revealed that majority of the people in Uganda use dial ups (43%), with leased lines on copper and optical and wireless taking 35% and 22% respectively of the study population. These results indicate a steady and remarkable improvement in the persons that use leased lines and wireless technologies.

5.6. ORGANIZATIONAL INFRASTRUCTURE

The organizational infrastructure is a measure that is based on the state of the ISP industry and market conditions. (Press et al., 1997) Admission to the ISP market is free. ISPs must be licensed (for which there is a fee) and supply up to two percent of annual revenue to the communications development fund (Minges et al., 2001). Recent statistics from UCC indicate that there are 17 registered ISPs. MTN and UTL hold a good percentage of the market. There have been developments in the ISP business with five companies coming together to purchase bandwidth . This is expected to cut down the cost of bandwidth. Current data support that each ISP in Uganda can buy up to 2-3 Meg of bandwidth for small ISPs while the big ones procure 5-6 Meg per month. Each Meg costs \$ 5,000 – \$ 6,000 to be landed in Uganda (Nakkazi; 2006). Purchasing bandwidth together has a number of advantages, one of which is a 25% purchase discount on 50 Meg. As illustrated in Table 8, these statistics all explain that Uganda is at Level 3 (Competitive) in terms of organizational infrastructure.

Table 8. Organizational Infrastructure of the Internet in Uganda

Level 0	None: The Internet is not present in this country.
Level 1	Single: A single ISP has a monopoly in the Internet service provision market. The ISP is generally owned or significantly controlled by the government.
Level 2	Controlled: There are only a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	Competitive: The Internet is competitive. There are many ISPs and low barriers to market to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or visa versa.
Level 4	Robust: There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

5.7. SOPHISTICATION OF USE

Sophistication of use is a measure that distinguishes usage from conventional to highly sophisticated and driving innovation. (Press et al., 1998) The most popular use in Uganda is e-mail. Many other uses are limited to searching the web and downloading software or music. There are several web sites that are being developed with a few specializing in e-commerce. The use of Internet is gradually getting increasingly sophisticated with a number of initiatives coming into existence. A number of banks now offer online banking to their corporate clients; travel agencies and hotels allow you to book online and many other developments. Recent research findings indicate the e-mail use among Ugandan's is the most popular use of the Internet and this is closely followed by research with business coming in next (Mwesige; 2004; Tushabe & Baryamureeba; 2005 & Tusubira, Kaggwa & Ongaro; 2005). For example one can purchase phone credit using one's mobile phone through one's bank account. One can also pay his/her utilities bills using a mobile phone. These and many more examples indicate the Internet-services developments within the country.

Table 9. Sophistication of Use of the Internet in Uganda

Level 0	None: The Internet is not used, except by a very small fraction of the population that logs into foreign services
Level 1	Minimal: The user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	Conventional: The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g e-mail vs. post). This is the first level at which we can say that the Internet has taken hold in a country.
Level 3	Transforming: The use of the Internet by certain segments of users results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities.
Level 4	Innovating: Segments of the user community are discriminating and highly demanding. These segments are regularly applying, or seeking to apply, the Internet in innovative ways that push the capabilities of the technology. They play a significant role in driving the state-of-the-art and have a mutually beneficial and synergistic relationship with developers.

6. LIMITATIONS

Perhaps, the use of secondary data appears to be a limitation. That's, the availability of primary data is a major challenge for researchers interested in investigating Internet diffusion especially in developing countries. However, we do argue that the use of secondary data from the International Telecommunications Union is adequate. Moreover, previous GDI studies (Bernstein and Goodman, 2005; Press, 1997) have made use of secondary data.

7. CONCLUSION

Both government and private institutions have embraced the use of IT especially in the Ugandan capital although the majority of Ugandans mainly use computers for word processing and spreadsheets. All banks in Uganda are automated to a certain extent. Despite the advancement of ICT in the country as a whole, the majority of institutions especially in the rural areas which accommodates more than 80% of the population as well as a number of government sectors have not adopted the use of IT. Some of the identified IT weaknesses in Uganda include : not fully developed telecommunication infrastructure, unreliable electric power, lack of research and development on technology, lack of trained professionals in IT, cost of Internet are high, slow adoption of IT, insufficient hardware and software and lack of trust on the Internet.

With Uganda having a liberalized communication policy, the development of new ISPs and technology related businesses has increased the communication infrastructure tremendously. These companies are privately owned and have permission to expand the infrastructure. By Uganda implementing this licensing policy, they are able to have an adequate telecommunications infrastructure and a highly competitive telecommunication industry. The advantage of the enhanced infrastructure gives the common citizen local, rapid, and inexpensive access to the global economy. (NICI Infrastructure, 2002)

8. REFERENCES

- Bernstein, A. and Goodman, S. (2005). Global Diffusion of the Internet VI: The Internet in Togo. *Communications of the Association for Information Systems (CAIS)*, 15(6), pp.371-392.
- Chance, C., and Booz, Allen & Hamilton Inc (1998). Case study of the impact of the changing international telecommunications environment on Uganda. Accessed November 15, 2006, from <http://www.itu.int/osg/spu/wptfwptf98/cases/index.html>
- CIA World Fact Book, (2006) "Uganda", Accessed November 06, 2006, from http://www.odci.gov/cia/publications/factbook_old/geos/ug.html
- Gitta, S., and Ikoja-Odongo, J.R. (2003). The Impact of Cybercafés on Information Services in Uganda. *First Monday*, 8(4). http://www.firstmonday.org/issues/issue8_4/gitta/
- Illungole S., Musoke K., & Muwanga D., (2005); What next after MTN, UTL Duoploy?, The NewVision Ltd. Accessed on October 18th, 2006 from <http://www.newvision.co.ug/PA/8/220/447236>
- Internet Around the World; (2001); Internet in East Africa: Uganda ; Accessed on 26th July 2006 from http://www.isoc.org/inet2001/CD_proceedings/G54/Inet2001_100501.htm

- Juuko, S. (2006). "Uganda needs to be 'Gifted with Profits' to grow-IMF", NewVision (Uganda) - AAGM Load Date: March 31, 2006.
- Kaggwa, I. (June 2000) Overview of the Internet in Uganda. The African Internet & Telecom Summit, Banjul, The Gambia.
- Mbarika, V., Okoli, C., Byrd, T., and Datta, P. (2005) The Neglected Continent of IS Research: A Research Agenda for Sub-Saharan Africa, *Journal of Association for Information Systems*, 6(5), pp.130-170
- Mbarika, V., Kah, M., Samake, K., and Sumrall, J. (Forthcoming). The Diffusion of Cyber Cafés in Sub-Saharan Africa: Country Case Studies. *IEEE Technology and Society*
- McLaughlin, A. (2004) Internet Exchange Points Their Importance to Development of the Internet and Strategies for their Deployment – The African Example, Global Internet Policy Initiative. Accessed on November, 14th 2006 from <http://www.Internetspolicy.net/practices/ixp.pdf>
- MEGA-TECH Inc (2006). The National ICT Master Plan and E-Governance Network Feasibility Study in Uganda
- Minges, M. (2001) Internet Around the World, International Telecommunication Union (ITU). Accessed on November 10 th, 2006 from http://www.isoc.org/inet2001/CD_proceedings/G54/Inet2001_100501.htm
- Minges, M., Brown, W., and Kelly, T. (2001). The Internet in an African LDC: Uganda Case Study. Accessed on November 9th, 2006 <http://www.itu.int/ITU-D/ict/cs/uganda/material/uganda.pdf>
- Molla, A.(2000) Africa and the Information economy: Foundations, opportunities, challenges and research agenda. *African Knowledge Networks Forum Preparatory Workshop*.
- Muhwezi-Bonge, G. (2006). Makerere University to Reduce Bandwidth Due to Lack of Funds, The Monitor (Uganda) – AAGM Load date April 4, 2006.
- Mwesige P.G.,(2004), Cyber elites: a Survey of Internet Café Users in Uganda; *Telematics & Informatics* 21(2004), 83-101
- Nakaweesi, D. (2006). UCC Challenges Government to Adopt ICT Policies. Accessed on October 10th, 2006 from http://rights.apc.org/africa/index.shtml?apc=21869n21849e_1
- Nakkazi E. (2006); Group of Uganda ISPs to Purchase Bandwidth Together. Accessed on July 2006 <http://www.mybroadband.co.za/nephp/?m=show&id=2619>
- New Vision, "Wireless Internet services in Uganda". <http://www.digitaloppurity.org/article/view/114823/1/> Accessed on April, 2006
- NICI Infrastructure, "Uganda", (2002) Accessed on February, 2006 from http://www.uneca.org/aisi/nici/country_profiles/uganda/uganab.htm
- Thomas, P. (2006); Internet Users Increases; The Newvision Ltd, Kampala. Accessed on October 19th, 2006 from <http://www.newvision.co.ug/PA/8/220/526486>

- Press, L. I. (1997). Tracking the global diffusion of the Internet. *Communications of the ACM*, 40(11), 11-17.
- Press, L. I., Burkhart, G. E., Foster, W., Goodman, S. E., Wolcott, P., & Woodard, J. (1998). An Internet diffusion framework. *Communications of the ACM*, 41(10), 21-26.
- The Monitor. (2005) "Uganda population at 27.5 million". All Africa, Inc. Africa News Load date October 22, 2005
- Tushabe F, & Baryamureeba V; (2005), Cyber Crime in Uganda: Myth or Reality? *Enformatika v8 2005 ISSN 1305-5313*
- Tusubira FF, Kaggwa Irene & Ongora; (2005), Uganda (Book Chapter) in Towards as African e-Index: ICT access and Usage 2005
- UCC (2006a): Rural Communications; Accessed on October 3rd, 2006 from <http://www.ucc.co.ug/rcdf/default.php>
- UCC (2006b); Report on the Survey for Internet Development in Uganda; UCC, Kampala-Uganda
- Uganda Communication Commission, (2003) <http://www.ucc.co.ug/> last updated November 4, 2005 (Current as of March 2006)
- Uganda Bureau of Statistics (2006). National Statistics. Accessed on October 10, 2006 from <http://www.ubos.org/>
- UNCTAD, (2001) United Nations Conference on Trade and Development Selected examples of e-enterprises in LDCs Accessed on October, 3rd, 2006 from. <http://www.ethiopiaknowledge.org/Final%20Papers/Selected%20examples%20of%20E-Commerce,%20UNCTAD.PDF>
- Wolcott, P. and Goodman, S.E. (2003). Introducing the global diffusion of Internet series, *Communications of Association for Information Systems (CAIS)*, 11, 555-559.
- Wolcott, P., Press, L., McHenry, W., Goodman, S., and Foster, W. (2001). A Framework for Assessing the Global Diffusion of the Internet, *Journal of the Association for Information Systems*, 2(6), 1-51 jais.aisnet.org/articles/2-6/article.pdf
- Xinhua News Agency. (2006). Roundup: Uganda's population growth threatens poverty reduction.